

**Problem 2.55** A lossless  $50\text{-}\Omega$  transmission line is terminated in a short circuit. Use the Smith chart to determine:

- (a) The input impedance at a distance  $2.3\lambda$  from the load.
- (b) The distance from the load at which the input admittance is  $Y_{\text{in}} = -j0.04\text{ S}$ .

**Solution:** Refer to Fig. P2.55.

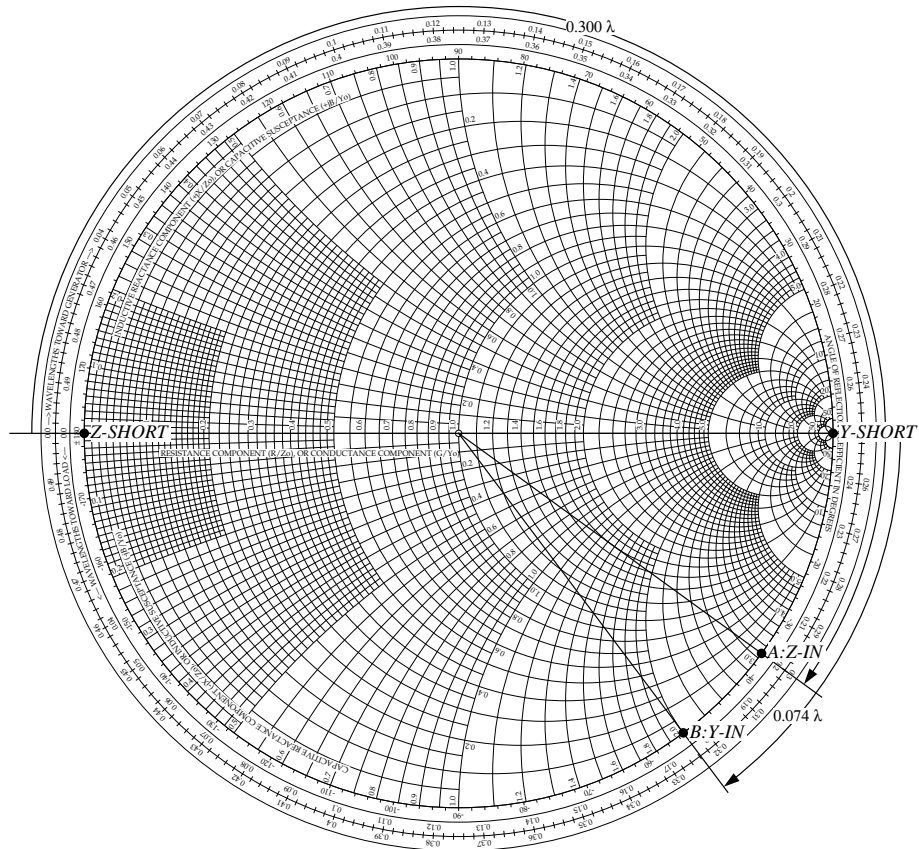
(a) For a short,  $z_{\text{in}} = 0 + j0$ . This is point *Z-SHORT* and is at  $0.000\lambda$  on the WTG scale. Since a lossless line repeats every  $\lambda/2$ , traveling  $2.3\lambda$  toward the generator is equivalent to traveling  $0.3\lambda$  toward the generator. This point is at *A : Z-IN*, and

$$Z_{\text{in}} = z_{\text{in}}Z_0 = (0 - j3.08) \times 50\ \Omega = -j154\ \Omega.$$

(b) The admittance of a short is at point *Y-SHORT* and is at  $0.250\lambda$  on the WTG scale:

$$y_{\text{in}} = Y_{\text{in}}Z_0 = -j0.04\text{ S} \times 50\ \Omega = -j2,$$

which is point *B : Y-IN* and is at  $0.324\lambda$  on the WTG scale. Therefore, the line length is  $0.324\lambda - 0.250\lambda = 0.074\lambda$ . Any integer half wavelengths farther is also valid.



**Figure P2.55:** Solution of Problem 2.55.